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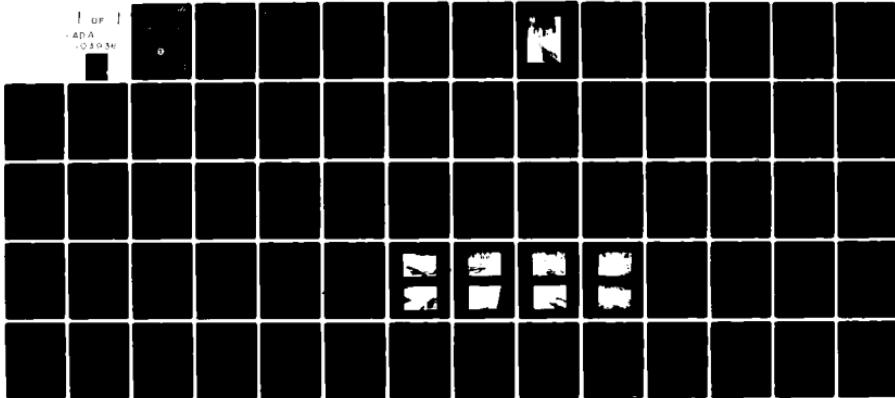
NEW JERSEY DEPT OF ENVIRONMENTAL PROTECTION TRENTON --ETC F/G 13/13  
NATIONAL DAM SAFETY PROGRAM, PENWELL MILL DAM (NJ 00781). DELAW--ETC(U)  
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DEL AWARE RIVER BASIN  
MUSCONETONG RIVER,  
HUNTERDON COUNTY  
NEW JERSEY

# PENWELL MILL DAM

## NJ 00781

### PHASE 1 INSPECTION REPORT NATIONAL DAM SAFETY PROGRAM



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Philadelphia District  
Corps of Engineers  
Philadelphia, Pennsylvania

REPT. NO. DAEN(NAF-53842) NJ 00781 -81/05

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.		



DEPARTMENT OF THE ARMY  
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS  
CUSTOM HOUSE-20 & CHESTNUT STREETS  
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO  
NAPEN-N

Mr. John O'Dowd, Acting Chief  
Bureau of Flood Plain Regulation  
Division of Water Resources  
N.J. Department of Environmental Protection  
P.O. Box CN029  
Trenton, NJ 08625

Dear Mr. O'Dowd:

We are forwarding, for your information, under separate cover the available copies of the Final Report for Penwell Mill Dam, NJ00781. Since the dam does not meet the size criteria for inclusion in the National Inventory of Dams, a Corps of Engineers Assessment has not been prepared. The report does, however, provide a valid indication of the condition of the dam.

Sincerely,

1 Incl (14 cys)  
As stated fwd sep

D. J. SHERIDAN  
Chief, Planning/Engineering Division

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DELAWARE RIVER BASIN  
MUSCONETCONG RIVER, HUNTERDON COUNTY  
NEW JERSEY

PENWELL MILL DAM

NJ00781

PHASE I INSPECTION REPORT  
NATIONAL DAM SAFETY PROGRAM

Penwell Mill Dam (NJ 00781). Delaware River  
Basin, Musconetong River. Hunterdon County,  
New Jersey. Phase 1 Inspection Report.

DEPARTMENT OF THE ARMY  
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS  
PHILADELPHIA, PENNSYLVANIA 19106

MAY 1981

PHASE I INSPECTION REPORT  
NATIONAL DAM SAFETY PROGRAM

Name: Penwell Mill Dam, I.D. NJ 00781  
State Located: New Jersey  
County Located: Hunterdon County  
Stream: Musconetcong River  
River Basin: Delaware River Basin  
Date of Inspection: January 12 and February 3, 1981

Assessment of General Conditions

Penwell Mill Dam is a concrete dam spanning the Musconetcong River. It is comprised of two overflow spillways separated by a small island. To the left of the dam are three timber stop plank sluice ways. The sluice way furthest to the left controls the flow to the mill. The overall condition of the dam is good. There are no major signs of distress. The downstream channel is well defined and in good condition. The hazard potential is recommended to be downgraded to "low".

Penwell Mill Dam is considered inadequate in view of its lack of spillway capacity to pass the SDF (100-year storm) without overtopping the dam. The spillway is capable of passing a flood equal to 7.6 percent of the SDF(100-year storm) and is assessed as "inadequate".

At present, the engineering data available is not sufficient to make a definitive statement on the stability of the dam, but based on the findings of the visual inspection, the preliminary assessment of static stability is that it is satisfactory. The following actions are recommended along with a timetable for their completion. All recommended actions should be conducted under the supervision of an Engineer who is experienced in the design, construction and inspection of dams.

1. The flow of seepage should be monitored monthly to determine its volume and whether it presents a problem to the safety of the dam.
2. Repair all spalled and deteriorated concrete on the abutments and wingwalls of the sluice ways within twelve months.
3. Replace all broken timber stop planks at the sluice ways within twelve months.

4. The owner should develop an emergency action plan (if one is not already available) outlining actions to be taken by the operator to minimize downstream effects of an emergency and establish a flood warning system for the downstream communities within three months.

Furthermore, while of a less urgent nature, the following additional actions are recommended and should be carried out within twelve months.

1. The owner should develop, within one (1) year after formal approval of the report, written operating procedures and a periodic maintenance plan to insure the safety of the dam.
2. Conduct a complete topographic survey of the dam and surrounding area, in order to develop a detailed plan and several cross-sections of the dam to form a coherent as-built set.



John P. Talerico, P.E.  
HARRIS-ECI ASSOCIATES



Photo taken February 3, 1981

PENWELL MILL DAM

View of dam looking towards the right from the low-level outlet.

## PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the office of the Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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PHASE I INSPECTION REPORT  
NATIONAL DAM SAFETY PROGRAM

PENWELL MILL DAM, I.O. NJ 00781

SECTION 1

1. PROJECT INFORMATION

1.1 General

a. Authority

The National Dam Inspection Act (Public Law 92-367, 1972) provides for the National Inventory and Inspection Program by the U.S. Army Corps of Engineers. This inspection was made in accordance with this authority under Contract C-FPM No. 35 with the State of New Jersey who, in turn, is contracted to the Philadelphia District of the Corps of Engineers, and was carried out by the engineering firm of Harris-ECI Associates, Woodbridge, New Jersey.

b. Purpose of Inspection

The visual inspection of Penwell Mill Dam was made on January 12 and February 3, 1981. The purpose of the inspection was to make a general assessment as to the structural integrity and operational adequacy of the dam embankment and its appurtenant structures.

c. Scope of Report

The report summarizes available pertinent data relating to the project; presents a summary of visual observations made during the field inspection; presents an evaluation of hydrologic and hydraulic conditions at the site; presents an evaluation as to the structural adequacy of the various project features; and assesses the general condition of the dam with respect to safety.

1.2 Description of Project

a. Description of Dam and Appurtenances

Penwell Mill Dam is a concrete dam about 239 feet in length. There is a 90 foot concrete spillway at the dam's right side and an 85 foot spillway, 1-inch higher than the right spillway, at the dam's left side. The two spillways are separated by an island approximately 64 feet wide in the river channel. To the immediate left of the left spillway is a 6 foot wide sluice way consisting of two concrete walls and timber stops planks. The stop planks are slotted into the bottom of the sluice way, and held in place by a vertical and a horizontal I beam. Adjacent to this sluice way is a 70 foot island.

On the island's left side is a second 6 foot sluice way consisting of two concrete walls and timber stop planks, which are held in place in the same manner as the other sluice way. Adjacent to this sluice way is an 8 foot section of the river bank that connects to a 12 foot wide outlet which supplies water to Penwell Mill by way of a raceway. The flow to the mill is controlled by timber stop planks. The planks are held in place by slots in the concrete wingwalls at the ends and a vertical steel I beam in the center. The concrete walls are 2.5 feet thick by 7 feet on the left and 5.5 feet on the right. The distance from the top of the walls to the spillway crest varies from 2 to 2.5 feet.

The flow from the sluice way adjacent to the left spillway discharges into the downstream channel at the bottom of the spillway. The flow from the other sluice way discharges into a narrow channel that meets the main channel (Musconetcong River) approximately 70 feet downstream from the spillway.

The Musconetcong River continues passing under the Penwell Road bridge through an 6.5 foot x 76 foot opening, approximately 400 feet downstream from the spillway.

A generalized description of the soil conditions is contained in Report No. 6, Hunterdon County, Engineering Soil Survey of New Jersey, by Rutgers University. The report dated 1952 describes the river area soil as recent alluvium. Recent alluvium can be described as materials with a wide range of grain sizes which often have been sorted into rough intermingled layers by successive stages of water action. The underlying formation is limestone of varying thickness with a depth to bedrock of greater than 10 feet. The NJ Department of Environmental Protection Geologic Overlay Sheet 24 describes the underlying rock as Undifferentiated Cambro-Ordovician.

b. Location

Penwell Mill Dam is located on the Musconetcong River in the Township of Lebanon, Hunterdon County, New Jersey. It is accessible from Route 57 at Penwell by way of Penwell Road.

c. Size Classification

According to the "Recommended Guidelines for Safety Inspection of Dams" by the U.S. Department of the Army, Office of the Chief of Engineers, the dam is classified in the dam size category as being "small", since its storage volume of 4 acre-feet is less than 1,000 acre-feet. The dam is also classified as "small" because its height of 6 feet is less than 40 feet. The overall size classification of Penwell Mill Dam is "small".

d. Hazard Classification

A hazard classification of "low" has been assigned to the dam. This is based on the fact that a hypothetical failure would not result in damage

to the one house 600 feet downstream on the left and four houses 2,000 feet downstream on the right and no loss of life can be expected in the event of dam failure.

e. Ownership

Penwell Mill Dam is owned by:

Isabella Thomas  
R.D.I., Box 46  
Port Murray, NJ 07865

Attention: Ralph B. Thomas  
(201)689-0353

f. Purpose

Penwell Mill Dam is presently used to supply water power to Penwell Mill.

g. Design and Construction History

Penwell Mill Dam was constructed as a timber crib-rock fill dam with timber overflow spillways, in 1861. An inspection in June of 1943, showed that a new plank crest and some concrete work at the left end had been done. In 1972 the left spillway was concreted and the right spillway was concreted in 1976.

h. Normal Operating Procedures

The discharge from the dam is unregulated and is allowed to naturally balance the inflow from the river.

1.3 Pertinent Data

a. <u>Drainage Area</u>	105.9 sq. miles
b. <u>Discharge at Dam Site</u>	
Ungated spillway capacity at elevation of top of dam:	498 cfs (410.5 NGVD)
Total spillway capacity at maximum pool elevation (SDF):	6,590 cfs (413.31 NGVD)
c. <u>Elevation</u> (Feet above NGVD)	
Top of dam:	410.5
Maximum pool design surcharge (SDF):	413.31
Recreation pool:	409.67
Spillway crest:	409.67
Streambed at centerline of dam:	404.5 (Estimated)
Maximum tailwater:	406 (Estimated)
d. <u>Reservoir</u>	
Length of maximum pool:	350 ft. (Estimated)
Length of recreation pool:	500 ft. (Estimated)
e. <u>Storage</u> (acre-feet)	
Spillway Crest:	3
Top of dam:	4
Maximum pool (SDF):	18
f. <u>Reservoir Surface</u> (acres)	
Top of dam:	2 (Estimated)
Maximum pool (SDF):	10 (Estimated)
Recreation pool:	1.67
Spillway crest:	1.67 (409.67 NGVD)

g. Dam

Type:	Concrete
Length:	353 ft. (Effective)
Height:	6 ft.
Top width:	Varies
Side slopes - Upstream:	Unknown
- Downstream:	
Zoning:	Unknown
Impervious core:	None
Cutoff:	None
Grout curtain:	None

h. Diversion and Regulating Tunnel

N/A

i. Spillway

Type:	Overflow weir
Length of weir:	Right-90 ft., Left-85 ft.
Crest elevation:	409.67 NGVD
Gates:	None
U/S Channel:	Musconetcong River
D/S Channel:	Musconetcong River

j. Regulating Outlets

Low level outlet:	2 - 6 ft. x 7 ft. deep sluice ways, 12 ft x 5 ft. deep raceway.
Controls:	Timber stop planks
Emergency gate:	None
Outlet:	405 NGVD (Estimated)

## SECTION 2

### 2. ENGINEERING DATA

#### 2.1 Design

There are no drawings or design computations for Penwell Mill Dam available. No data from soil borings, soil tests or other geotechnical data is available. The only information relating to the dam is a copy of an inspection report done by the State Water Policy Commission on file at the Trenton offices of the NJ Department of Environmental Protection (NJ-DEP).

#### 2.2 Construction

Data is not available concerning the as-built construction of the dam. No data exists on the construction methods, borrow sources, or other data pertinent to the construction of the dam.

#### 2.3 Operation

Formal operation records are not kept for the dam. The overflow from the dam is unregulated and the river is allowed to operate naturally.

#### 2.4 Evaluation

##### a. Availability

The availability of engineering data is very poor. The stated information concerning the dam is available from the NJ-DEP.

##### b. Adequacy

The engineering data available together with that obtained in the field, was adequate to perform hydrologic and hydraulic computations. The data was insufficient to perform a stability analysis, but preliminary evaluation could be made based on visual observations.

##### c. Validity

Information contained in a previous inspection report and checked by limited field measurement appears to be valid.

## SECTION 3

### 3. VISUAL INSPECTION

#### 3.1 Findings

##### a. General

The visual inspection of Penwell Mill Dam revealed the dam and spillways to be in good condition, but in need of minor repairs. The river level was above the crest of the spillways at the time of the inspection.

##### b. Dam

The right and left sections of the concrete overflow dam appear sound. No spalling or cracks were noticed along the top or downstream face of the dam. No misalignment of the dam in the horizontal or vertical planes was evident. All visible construction joints appeared in good condition.

##### c. Appurtenant Structures

###### 1. Spillways

The entire length of the right and left sections of the dam are the spillways.

###### 2. Outlet Works

Two 6 foot sluice ways serve as low-level outlets. One adjacent to the left spillway and the other 70 feet to the left of the first. Timber stop planks, slotted into the concrete and held in place by a vertical and horizontal I-beam, are used to control the flow through the sluice ways. At both locations the stop planks were broken, allowing water to flow between the planks.

There is minor spalling on the downstream face of the left abutment for the sluice way at the left spillway. The lower portion of the downstream face of both abutments for the left sluice way are heavily spalled and deteriorated exposing the rock fill. The concrete at the water level of both walls has completely deteriorated resulting in undermining of the abutments.

There is also a 12-foot outlet, which supplies water to the mill by way of a raceway, located 8 feet to the left of the second sluice way. Timber stop planks slotted into the concrete and held in place by a vertical I-beam, are used to control the flow. At this location some of the planks were broken allowing water to flow under the flash board instead of over it. The concrete on the downstream face of both wingwalls is heavily spalled.

Minor seepage was observed at the base of the left abutment of the sluice way adjacent to the left spillway.

d. Reservoir Area

Slopes on both sides of the reservoir are steep to flat and partially wooded. There is no indication of slope instability.

e. Downstream Channel

The downstream channel is in good condition. There is a small island immediately downstream in the river channel near the left spillway. The slopes of the river are relatively flat, shallow and wooded.

Approximately 400 feet from the spillway, Penwell Road bridge crosses the channel. There is one house about 600 feet downstream on the river's left bank and another four houses approximately 2,000 feet downstream of the dam on the right bank. All five buildings are above the flood plain.

## SECTION 4

### 4. OPERATIONAL PROCEDURES

#### 4.1 Procedures

Penwell Mill Dam is used to impound water which is used as a power source for Penwell Mill. The level of the impounded water is maintained through the unregulated flow over the spillways.

#### 4.2 Maintenance of the Dam

There is no regular inspection and maintenance program for the dam. The owner of Penwell Mill is responsible for the maintenance of the dam.

#### 4.3 Maintenance of Operating Facilities

The low-level outlets consists of two sluice ways and a raceway to the mill. All three outlets consists of two concrete walls and a series of timber stop planks slotted into the concrete and held in place by steel I-beams. The water level can be lowered by the removal of the stop planks. At the time of inspection there were broken stop planks at all three locations, allowing water to flow through.

#### 4.4 Evaluation

The present operational and maintenance procedures are fair with the dam and spillway being maintained in a serviceable condition.

## SECTION 5

### 5. HYDRAULIC/HYDROLOGIC

#### 5.1 Evaluation of Features

##### a. Design

The drainage area above Penwell Mill Dam is approximately 105.9 square miles. A drainage map of the watershed of the dam site is presented on Plate 1, Appendix D.

The topography within the basin is generally moderate to steeply sloped. Elevations range from approximately 1200 feet above NGVD at the north end of the watershed to about 410 feet at the dam site. Land use patterns within the watershed are mostly undeveloped and wooded with some residential development around the upstream lake areas.

The evaluation of the hydraulic and hydrologic features of the dam was based on criteria set forth in the Corps guidelines and additional guidance provided by the Philadelphia District, Corps of Engineers. The SDF for the dam is the 100-year storm.

The 100-year Flood was calculated from 100-year precipitation using National Weather Service Hydro - 35 and Technical Paper No. 40. Snyders coefficients  $C_t = 3.7$  and  $C_p = 0.557$  were used to develop a synthetic unit hydrograph.

Initial and constant infiltration loss rates were applied to the 100- year rainfall to obtain rainfall excesses. The rainfall excesses were applied to the unit hydrograph to obtain the 100-year Flood hydrograph utilizing program HEC-1-DB.

The SDF peak outflow calculated for the dam is 6,590 cfs. This value is derived from the 100-year flood, and results in overtopping of the dam, assuming that the lake was originally at the spillway crest elevation.

The stage-outflow relation for the spillway was determined from the geometry of the spillway and dam, utilizing HEC-1-Dam Safety Version program.

The reservoir stage-storage capacity relationship was computed directly by the conic method, utilizing the HEC-1-DB program. The reservoir surface areas at various elevations were measured by planimeter from a U.S.G.S. Quadrangle topographic map. Reservoir storage capacity included surcharge levels exceeding the top of the dam, and the spillway rating curve was based on the assumption that the dam remains intact during routing. The spillway rating curve is presented in the Hydrologic Computation, Appendix D.

Drawdown calculations indicate that to empty the lake to an elevation of 406 NGVD through the three stop plank outlets would take 4.5 minutes, assuming a 2 cfs/square mile inflow. This is not considered to be an excessive drawdown period.

b. Experience Data

No records of reservoir stage or spillway discharge are maintained for this site.

c. Visual Observation

The downstream channel, of the Musconetcong River, is fairly wide with relatively flat, shallow and wooded slopes. The river passes under Penwell Road 400 feet downstream of the dam. There is one house 600 feet downstream of the dam on the left and four houses 2000 feet downstream on the right.

The side slopes of the reservoir are steep to flat and do not exhibit any signs of instability. The drainage area is wooded and moderately to steeply sloped.

d. Overtopping Potential

A storm of magnitude equivalent to the SDF would cause overtopping of the dam to a height of 2.81 feet. Computations indicate that the dam can pass approximately 7.6 percent of the 100-year storm without overtopping the dam crest. Since the 100-year storm is the Spillway Design Flood (SDF) for this dam, according to the Recommended Guidelines for Safety Inspection of Dams by the Corps of Engineers, the spillway capacity of the dam is assessed as "inadequate".

## SECTION 6

### 6. STRUCTURAL STABILITY

#### 6.1 Evaluation of Structural Stability

##### a. Visual Observations

At the time of inspection Penwell Mill Dam did not exhibit any visible signs of major distress. There was no evidence of tilting, misalignment or movement on the foundation. Minor seepage was observed near the base of the downstream face of the left abutment of the sluice way adjacent to the left spillway. There was some spalling and patchwork on the downstream abutment faces at all three outlets. In addition, at the left sluice way, the concrete has deteriorated at the water level on both walls causing undermining of the walls. Numerous trees are growing on the islands between the spillways and between the sluice ways.

##### b. Design and Construction Data

No design computations were uncovered during the report preparation phase. No construction data, plans or geotechnical data are available for carrying out a conventional stability analysis on the dam.

##### c. Operating Records

No operating records are available relating to the stability of the dam.

##### d. Post-Construction Changes

In 1972 the left spillway was concreted and in 1976 the right spillway was concreted.

##### e. Static Stability

A static stability analysis was not performed for Penwell Mill Dam because the lack of data on which to base assumptions of material properties within embankment zones might produce misleading results, but based on the findings of the visual inspection, the preliminary assessment of static stability is that it is satisfactory.

f. Seismic Stability

The dam is located in Seismic Zone 1, as defined in Recommended Guidelines for Safety Inspection of Dams, prepared by the Corps of Engineers. In general, projects located in Seismic Zones 0, 1 and 2 may be assumed to present no hazard from earthquake, provided the static stability conditions are satisfactory and conventional safety margins exist, and based on the findings of the visual inspection, the preliminary assessment of the static and seismic stabilities is that they are satisfactory.

## SECTION 7

### 7. ASSESSMENT/REMEDIAL MEASURES

#### 7.1 Dam Assessment

##### a. Safety

The dam has been inspected visually and a review has been made of the available engineering data. This assessment is subject to the limitations inherent in the visual inspection procedures stipulated by the Corps of Engineers for a Phase I report.

Penwell Mill Dam is inadequate because the dam does not have the spillway capacity to pass the SDF, 100-year storm, without overtopping. The present spillway capacity of the dam is approximately 7.6 percent of the 100-year storm.

No definitive statement pertaining to the safety of the embankment can be made without acquisition of embankment material engineering properties, but based on the findings of the visual inspection, preliminary assessment of the static stability is that it is satisfactory.

##### b. Adequacy of Information

The information uncovered was adequate to perform hydrologic and hydraulic computations. The data was insufficient to perform even an approximate computation of the stability of the dam. A preliminary assessment of the dam could be made by visual observation only.

##### c. Urgency

The remedial measures and recommended actions along with a timetable for their completion are detailed below. All recommended action should be conducted under the supervision of an engineer who is experienced in the design, construction and inspection of dams.

#### 7.2 Remedial Measures

##### a. Alternatives for Increasing Spillway Capacity

Alternatives for increasing spillway capacity are not required as the hazard potential of the dam is rated as "low".

b. Recommendations

1. The flow of seepage should be monitored monthly to determine its volume and whether it presents a problem to the safety of the dam.
2. Repair all spalled and deteriorated concrete on the abutments and wingwalls of the sluice ways within twelve months.
3. Replace all broken timber stop planks at the sluice ways within twelve months.

The following additional actions are recommended:

1. The owner should develop an emergency action plan (if one is not already available) outlining actions to be taken by the operator to minimize downstream effects of an emergency and establish a flood warning system for the downstream communities within three months.
2. Conduct a complete topographic survey of the dam and surrounding area, in order to develop a detailed plan and several cross-sections of the dam to form a coherent as-built set.

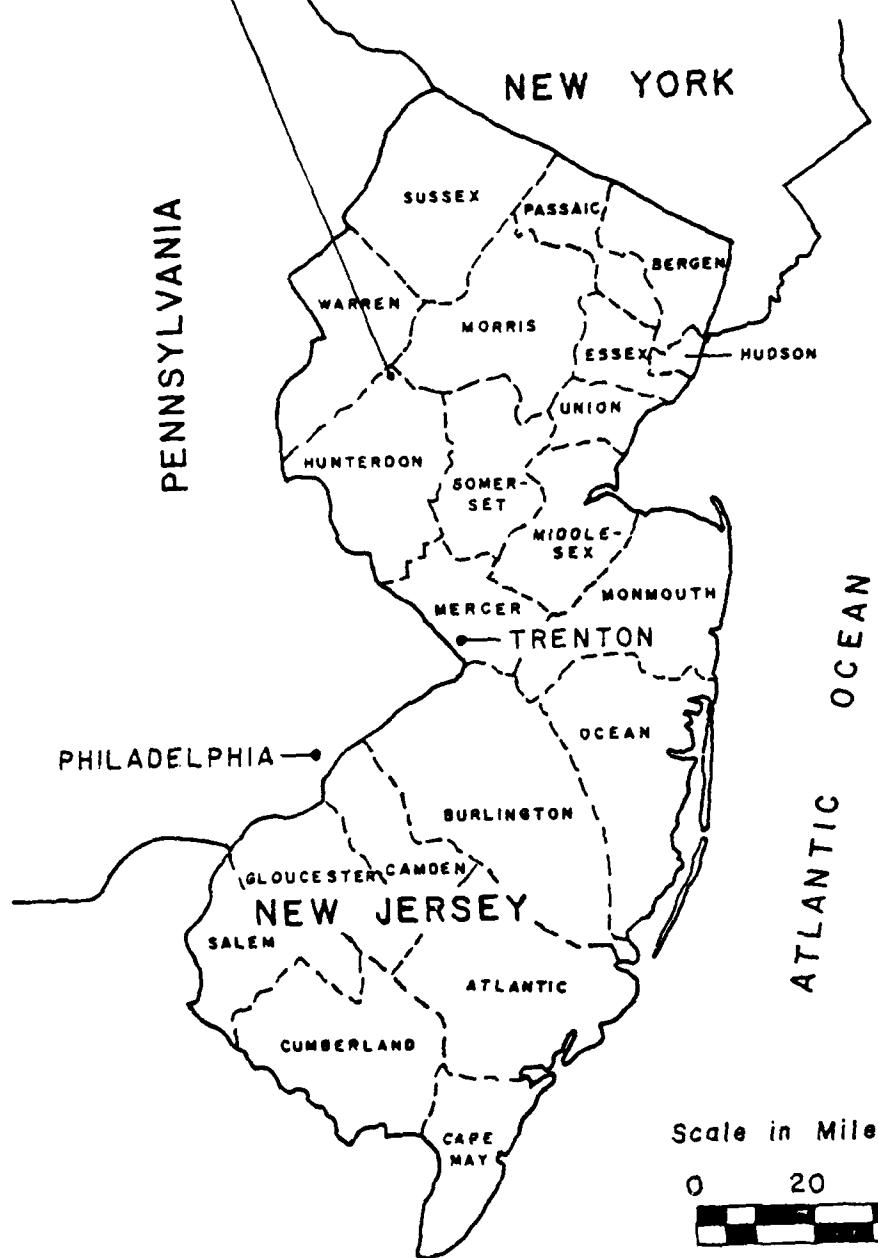
c. O & M Procedures

The owner should develop, within one (1) year after formal approval of the report, written operating procedures and a periodic maintenance plan to insure the safety of the dam.

PLATES

PENWELL MILL DAM

LEBANON TOWNSHIP  
HUNTERDON CO., N. J.

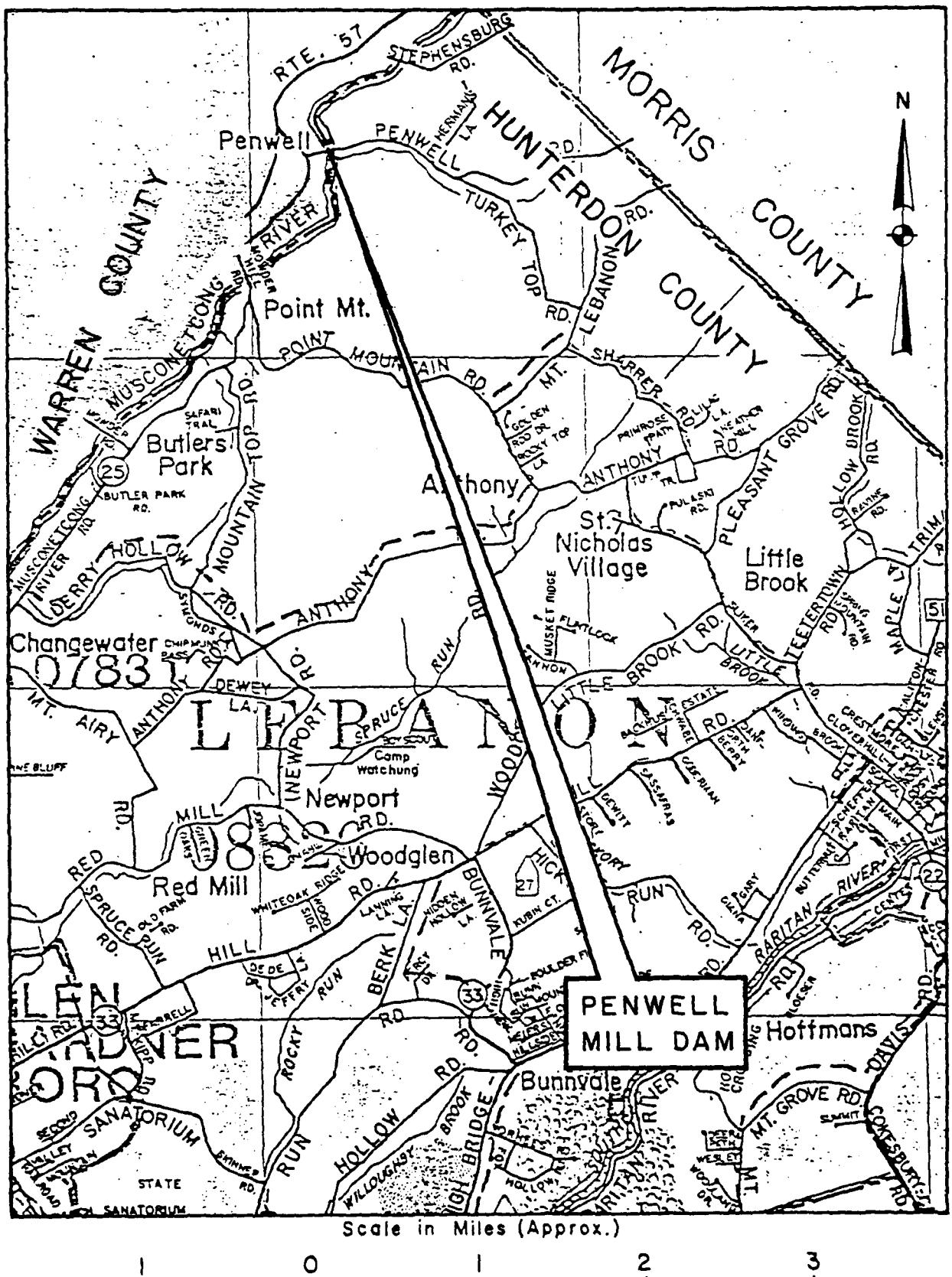


Scale in Miles (Approx.)

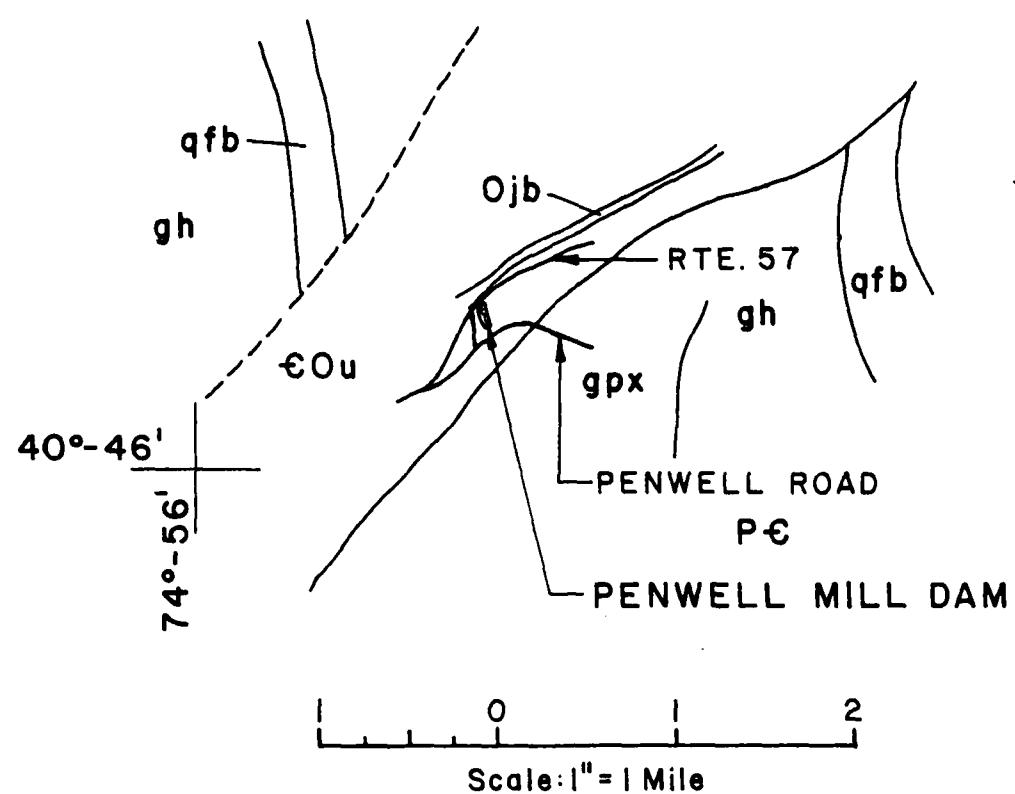


KEY MAP

PLATE 1



VICINITY MAP



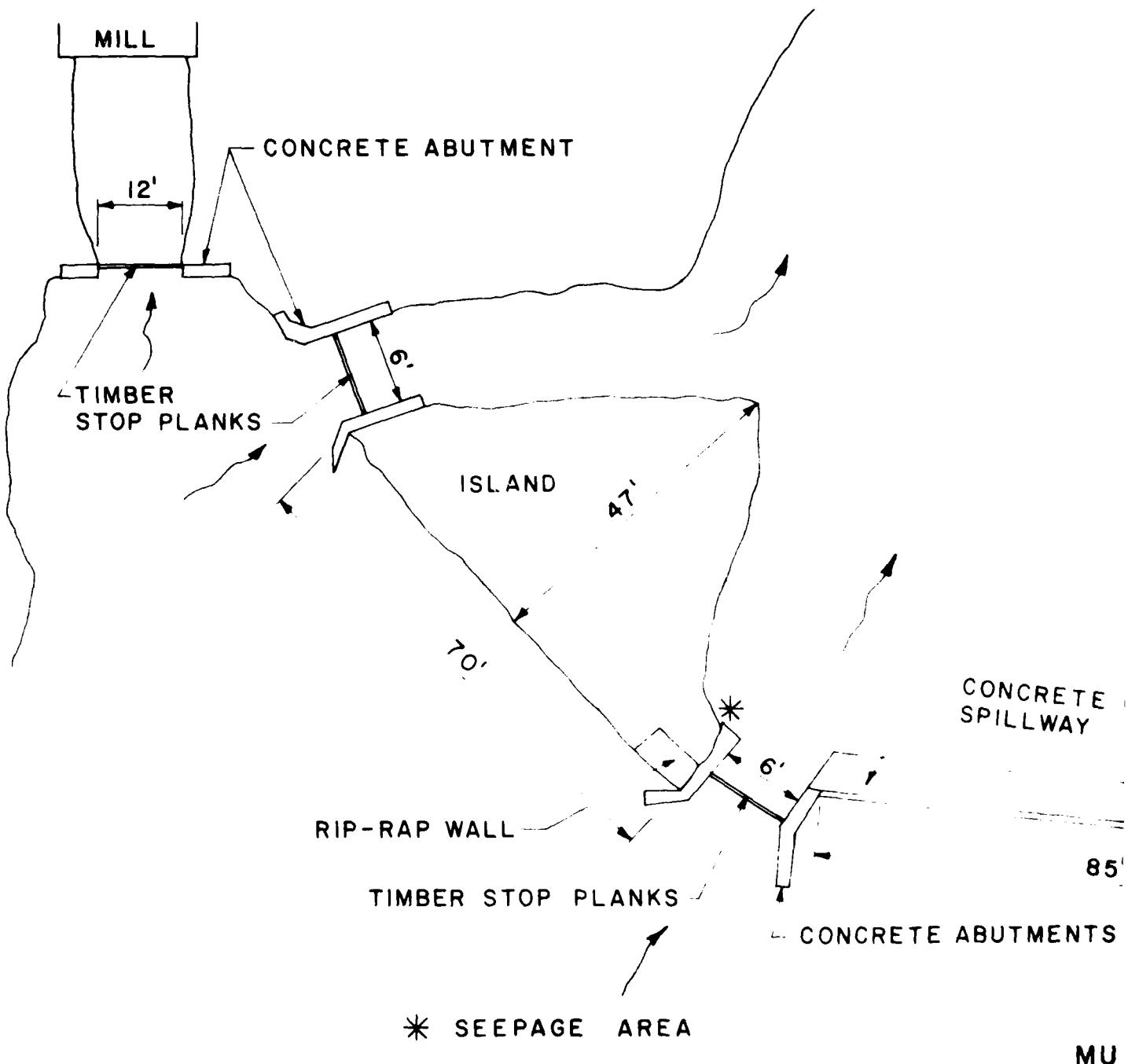
### LEGEND

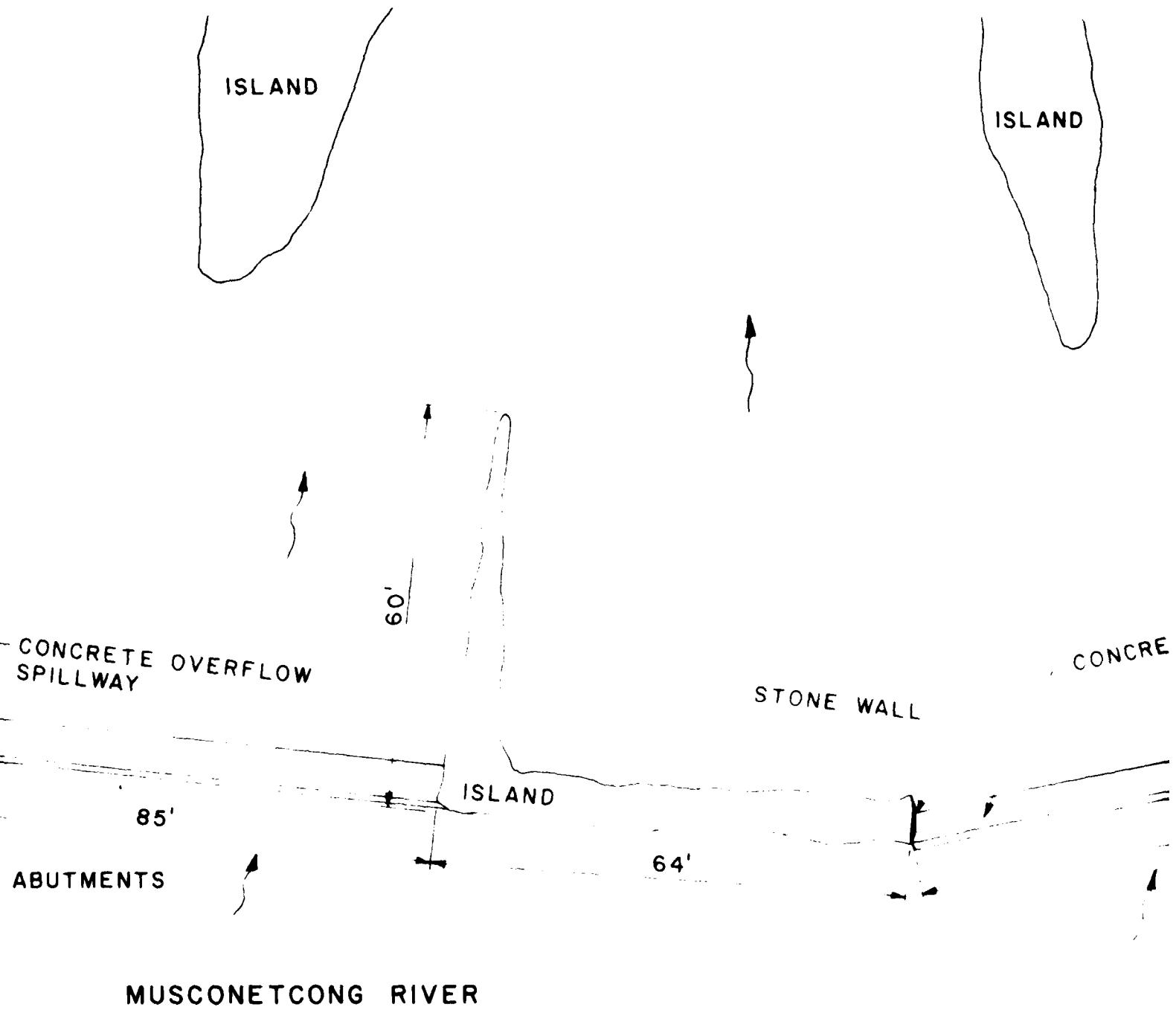
- ORDOVICIAN
- Ojb Jacksonburg Formation
- CAMBRO-ORDOVICIAN
- €Ou Undifferentiated Cambro-Ordovician
- PRE-CAMBRIAN
- P€ Undifferentiated Pre-Cambrian
- gh Hornblende Granite
- gpx Pyroxene Gneiss
- qfb Quartz-Feldspar-Biotite Gneiss

#### FAULT

(Dashed Where Inferred)

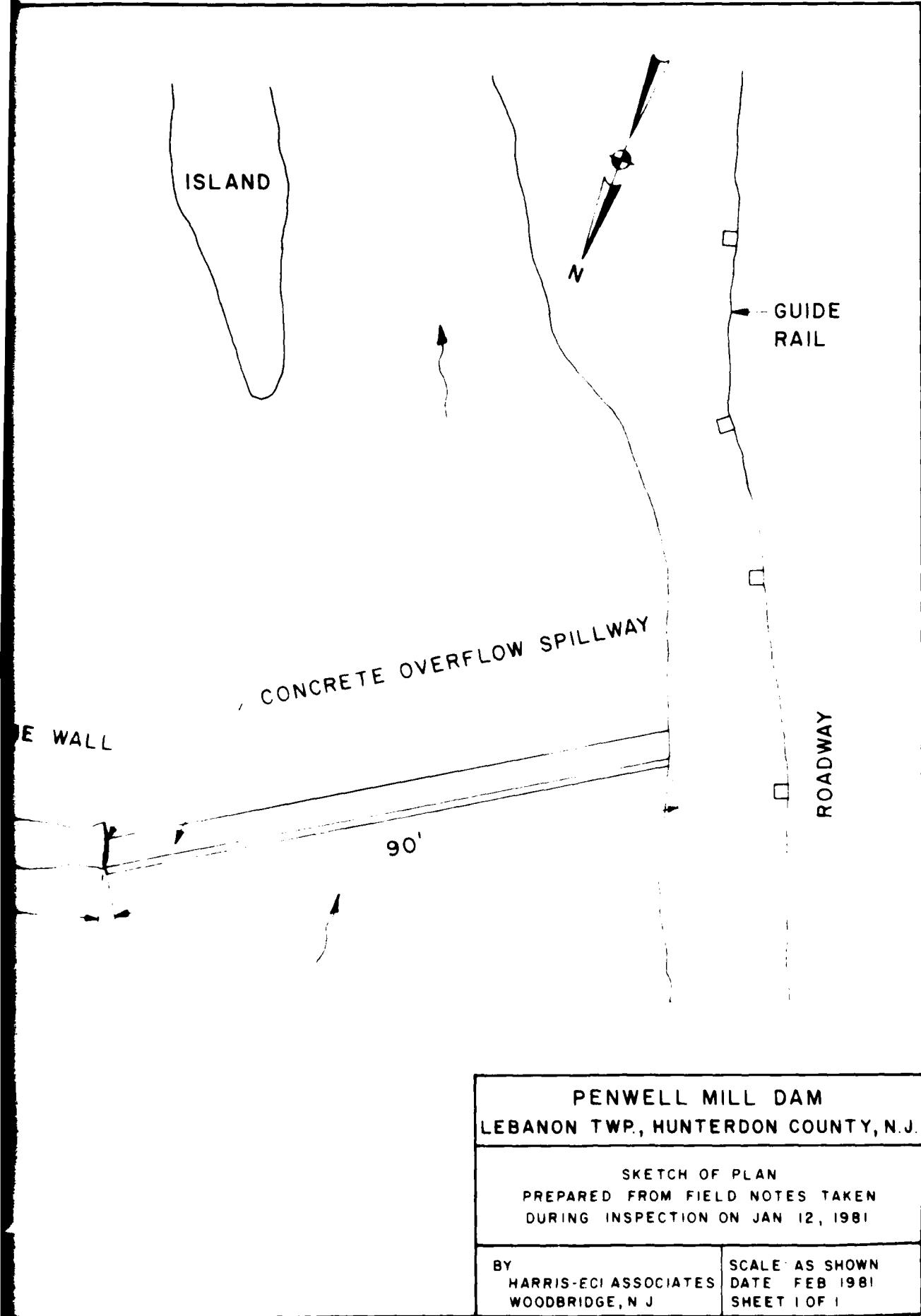
### GEOLOGIC MAP PENWELL MILL DAM





## PLAN

SCALE: 1" = 20'



APPENDIX A  
CHECK LIST - VISUAL OBSERVATIONS  
CHECK LIST - ENGINEERING, CONSTRUCTION  
MAINTENANCE DATA

CHECK LIST  
VISUAL INSPECTION  
PHASE 1

Name Dam Penwell Mill Dam County Hunterdon State New Jersey Coordinator NJ-DEP

Date(s) Inspection January 12, 1981 Weather Clear Temperature -10° F  
February 3, 1981 Cloudy 20° F

Pool Elevation at Time of Inspection 409.7 NGVD Tailwater at Time of Inspection 406 NGVD

Inspection Personnel:

January 12, 1981 February 3, 1981

William Birch  
Thomas Moroney  
Joseph Siriamni (Recorder)

OWNER/REPRESENTATIVE:

Harold Thomas  
R. D. I. Box 46  
Port Murray, NJ 07865  
(Did not attend)

## CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SEEPAGE OR LEAKAGE	None observed	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Minor seepage observed at base of downstream face of left abutment of sluice way adjacent to left spillway.	Monitor for clearness and quantity.
DRAINS	None.	
WATER PASSAGES	None.	
FOUNDATIONS	Unknown.	

## CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES		
	None observed. Water flowing over spillway.	
STRUCTURAL CRACKING		
	None observed.	
VERTICAL & HORIZONTAL ALIGNMENT		
	Horizontal and vertical alignments appeared good for both spillways.	
MONOLITH JOINTS		
	N/A	
CONSTRUCTION JOINTS		
	Good.	

## EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
EARTH EMBANKMENT	<p>Island between spillways with some trees, also island between outlets 1 and 2 with some trees growing on it.</p>	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Good.	
ANY NOTICEABLE SEEPAGE	None.	
STAFF GAGE AND RECORDER	None.	
DRAINS	None.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CRACKING & SPALLING OF CONCRETE SURFACES IN STILLING BASIN	None visible stilling basins were under water.	
INTAKE STRUCTURE	3 stop plank structures. First two are sluice ways used as low-level outlets, the third structure leads to a raceway leading to the mill. Upper planks are broken on both low-level outlets and there is leakage between the planks at all three outlets.	Replace the broken timber stop planks.
OUTLET STRUCTURE	All outlets have slotted concrete abutments that hold the stop planks. There is spalling on the downstream faces of the concrete walls at all three outlets. At the left low-level outlet the concrete on both abutments has deteriorated at the water level causing the walls to be undermined.	Repair spalled concrete and the deteriorated walls.
OUTLET FACILITIES	Junctions of all outlets to embankments are good.	
EMERGENCY GATE	None.	5

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONCRETE WEIR	<p>Concrete overflow weir in two sections: Right - approximately 90 feet long and 5 feet high. Left - approximately 85 feet long and 5.5 feet high  Both are in good condition.</p>	
APPROACH CHANNEL	<p>Musconetcong River</p>	
DISCHARGE CHANNEL	<p>Musconetcong River</p>	
BRIDGE AND PIERS	<p>None.</p>	

## INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
MONUMENTATION/SURVEYS		
None.		
OBSERVATION WELLS		
None.		
WEIRS		
None.		
PIEZOMETERS		
None.		
OTHER		
None.		

## RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS	
SLOPES	Slopes are steep to flat on both sides and partially wooded. Route 57 is along the right bank.		
SEDIMENTATION	None visible.		

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
No debris, small island in river channel by left spillway.		
SLOPES	Slopes are flat, shallow and wooded.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	Penwell Road bridge with utility conduit is 400 feet downstream. There is one house on left bank 600 feet downstream and four houses on the right approximately 2,000 feet downstream.	

CHECK LIST  
ENGINEERING DATA  
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	None available.
REGIONAL VICINITY MAP	Available-Hunterdon County Map and U.S.G.S. Quadrangle Sheet for Washington, N.J.
CONSTRUCTION HISTORY	No formal history exists, but can be deduced from available microfilm at NJ Department of Environmental Protection (NJ-DEP), 1474 Prospect Street, P.O. Box CN-029, Trenton, NJ 08625
TYPICAL SECTIONS OF DAM	None available.
HYDROLOGIC/HYDRAULIC DATA	None available.
OUTLETS - PLAN	None available.
- DETAILS	None available.
- CONSTRAINTS	None available.
- DISCHARGE RATINGS	None available.
RAINFALL / RESERVOIR RECORDS	None available.

CHECK LIST  
 ENGINEERING DATA  
 DESIGN, CONSTRUCTION, OPERATION  
 (continued)

ITEM	REMARKS
DESIGN REPORTS	None available.
GEOLOGY REPORTS	Available U.S.G.S. Geologic Overlay Sheet for Hunterdon County and Engineering Soil Survey of New Jersey, Report No. 6, Hunterdon County by Rutgers University (New Brunswick, N.J.)
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None available.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available.
POST-CONSTRUCTION SURVEYS OF DAM	None.
BORROW SOURCES	Unknown.
SPILLWAY PLAN - SECTIONS - DETAILS	None available.

CHECK LIST  
 ENGINEERING DATA  
 DESIGN, CONSTRUCTION,  
 (continued)  
 OPERATION

ITEM	REMARKS
OPERATING EQUIPMENT PLANS AND DETAILS	None available.
MONITORING SYSTEMS	None.
MODIFICATIONS	Left spillway concreted in 1972. Right spillway concreted in 1976.
HIGH POOL RECORDS	Not kept.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Available on microfilm at NJ Department of Environmental Protection (NJ-DEP), 1474 Prospect Street, P.O. Box CN-029, Trenton, NJ 08625
PRIOR ACCIDENTS OF FAILURE OF DAM - DESCRIPTION - REPORTS	None known to exist.
MAINTENANCE OPERATION RECORDS	None known to exist.

APPENDIX B

PHOTOGRAPHS

(Photographs Taken February 3, 1981)

PENWELL MILL DAM



Photo 1 - View of left spillway and upstream river.



Photo 2 - View of right spillway looking towards island that separates the spillways.

PENWELL MILL DAM



Photo 3 - View left spillway and low-level outlet from downstream.

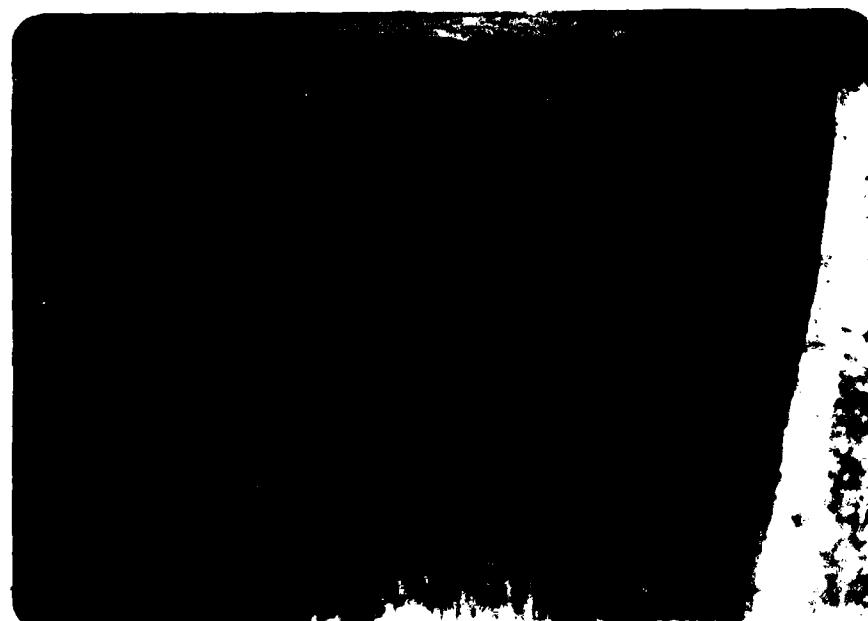


Photo 4 - View of broken timber stop planks of low-level outlet at the left spillway.

PENWELL MILL DAM

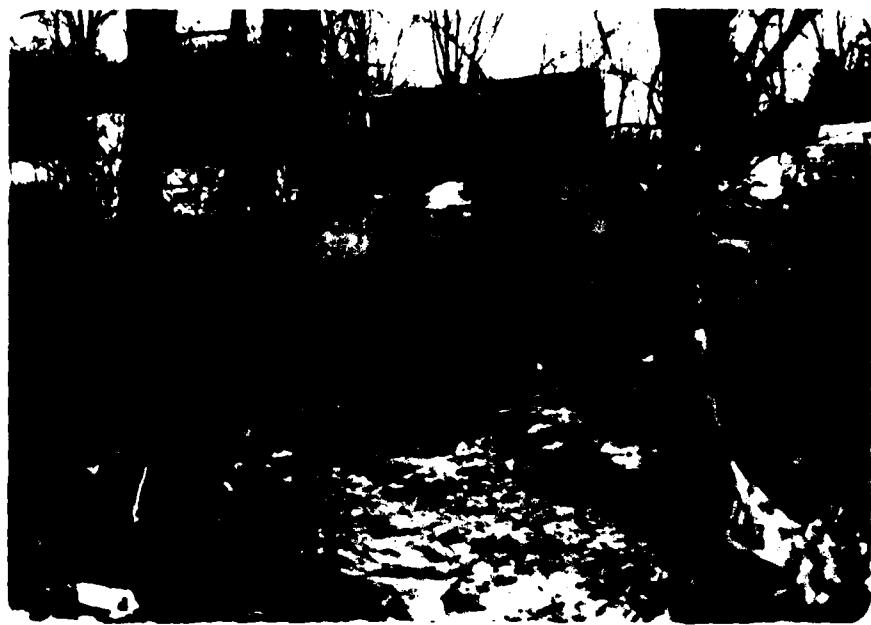


Photo 5 - Downstream view of left low-level outlet. Note deterioration and undermining of bottom of concrete walls.



Photo 6 - Downstream view of outlet and raceway leading to mill.

PENWELL MILL DAM



Photo 7 - View of downstream channel looking upstream towards dam.



Photo 8 - View downstream at Penwell Road bridge looking downstream.

APPENDIX C

SUMMARY OF ENGINEERING DATA

1.

CHECK LIST  
HYDROLOGIC AND HYDRAULIC DATA  
ENGINEERING DATA

Name of Dam: PENWELL MILL DAM

Drainage Area Characteristics: 105.9 sq. mi.

Elevation Top Normal Pool (Storage Capacity): 409.67 NGVD (3 acre-feet)

Elevation Top Flood Control Pool (Storage Capacity): N/A

Elevation Maximum Design Pool: 413.31 NGVD (SDF pool: 18 acre-feet)

Elevation Top Dam: 410.5 NGVD (4 acre-feet)

SPILLWAY CREST:

a. Elevation 409.67 NGVD - Both spillways

b. Type 2 concrete overflow spillways.

c. Width 1 ft.

d. Length Left - 85 ft. Right - 90 ft.

e. Location Spillover Entire length, both spillways

f. No. and Type of Gates None

OUTLET WORKS:

a. Type 3 - stop plank sluice ways

b. Location One located adjacent to left spillway, another 70 ft. left of 1st one & the third one 8 ft. left of the second.

c. Entrance Inverts 405 NGVD (Estimated)

d. Exit Inverts 405 NGVD (Estimated)

e. Emergency Draindown Facilities Timber stop planks

HYDROMETEOROLOGICAL GAGES:

a. Type None

b. Location None

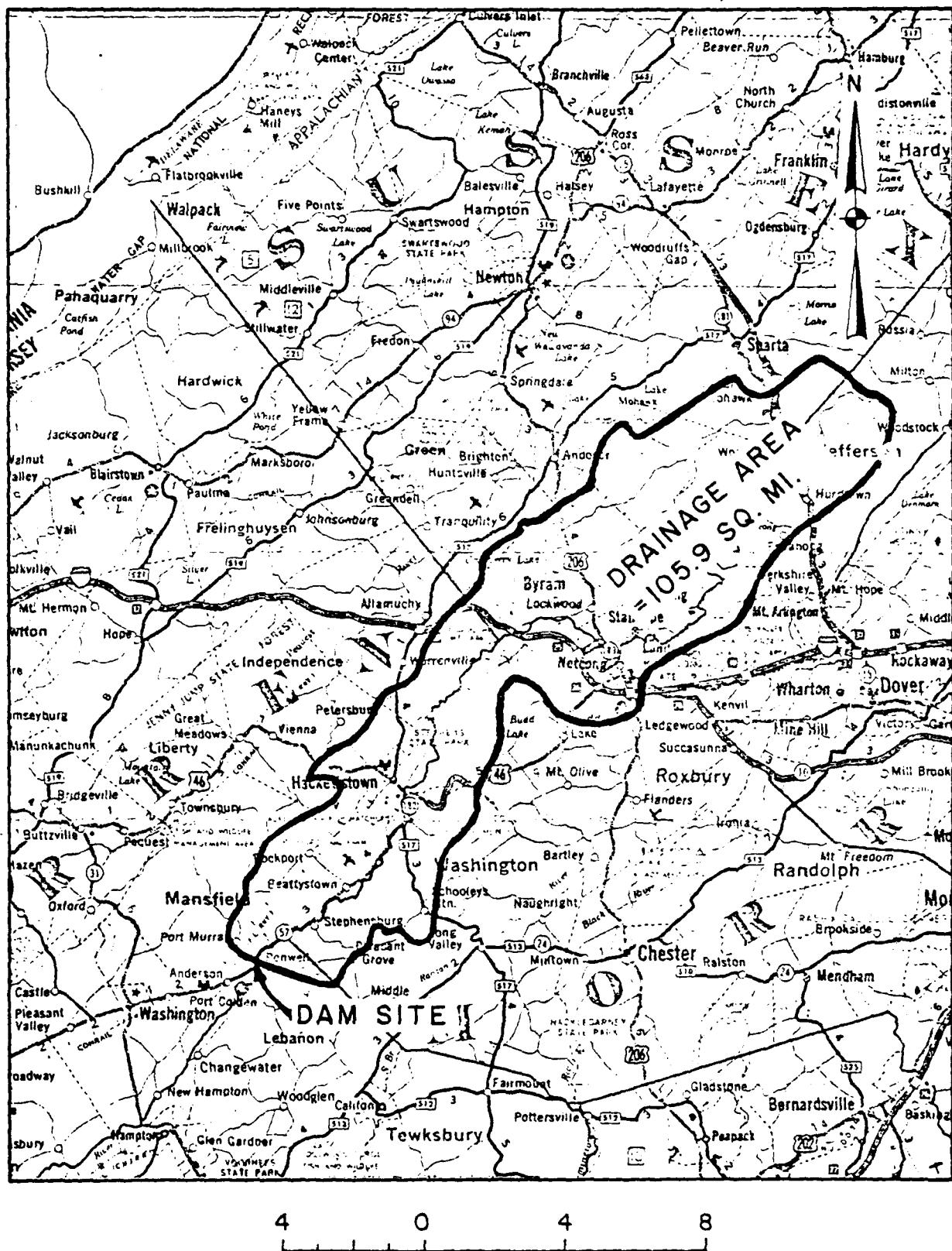
c. Records None

MAXIMUM NON-DAMAGING DISCHARGE: 498 cfs at elevation 410.5 NGVD

APPENDIX D

HYDROLOGIC COMPUTATIONS

PLATE I, APPENDIX D



Scale: 1" = 4 Miles

PENWELL MILL DAM  
DRAINAGE BASIN

Area of the Lake at normal pool level

(No information available from any source.  
U.S.G.S. Quad does not show any lake.  
From field observation it is estimated  
that the lake is 150 ft long.)

$$\text{Area} = 353 \text{ Ft} (\text{Length of Sickey Island}) \times 205 \text{ FT} \\ = 1.67 \text{ Ac}$$

Height of the Dam = 6 ft (Max)

Small Dam, Low Hazard

S.D.F. = 100 Year flood

### Hydrologic analysis

$$D.A. = 165.9 \text{ sq miles}$$

Inflow hydrograph at reservoir was determined  
using HEC 1 DB program. Inflow routed  
through the reservoir.

### Reservoir Stage Area Relations

Elevation	Area in Ac
405	0
409.67	1.67 Ac
420	27.55 Ac

Reservoir storage stage relationship was determined  
by HEC 1 DB program from the area stage  
relationship.

PRC Harris, Inc.  
CONSULTING ENGINEERS

SUBJECT: N.J. Dam Inspection  
Penwell Mills Dam  
COMPUTED BY: SB CHECKED BY:

SHEET NO. 2 OF 1  
JOB NO. 10-1176-01  
DATE Dec 1981

Precipitation Frequency Values (inches) of 100 yr. For

60 min. 3.05 Ref. NWS-Hydro - 35-

2 hr. 3.88

3 hr. 4.35

4 hr. 4.73

5 hr. 4.98

6 hr. 5.20

Ref. NWS-TP No. 40

PRC Harris, Inc.  
CONSULTING ENGINEERS

SUBJECT... N.J. Dam Inspection  
..... Pennwell Dam  
COMPUTED BY... S.B. CHECKED BY.....

3  
SHEET NO. 3 OF  
JOB NO. 10-1176-07  
DATE. May, 1981

100 year Rainfall distribution (1 hr duration)

Time (hr)	Total depth (inch)	4d inch.
1	3.05	3.05
2	3.88	.83
3	4.35	.47
4	4.73	.38
5	4.98	.25
6	5.20	.22

Rainfall design arrangement

.25, .83, 3.05, .47, .38, .22

4  
NYDERS UNG PARAMETERS



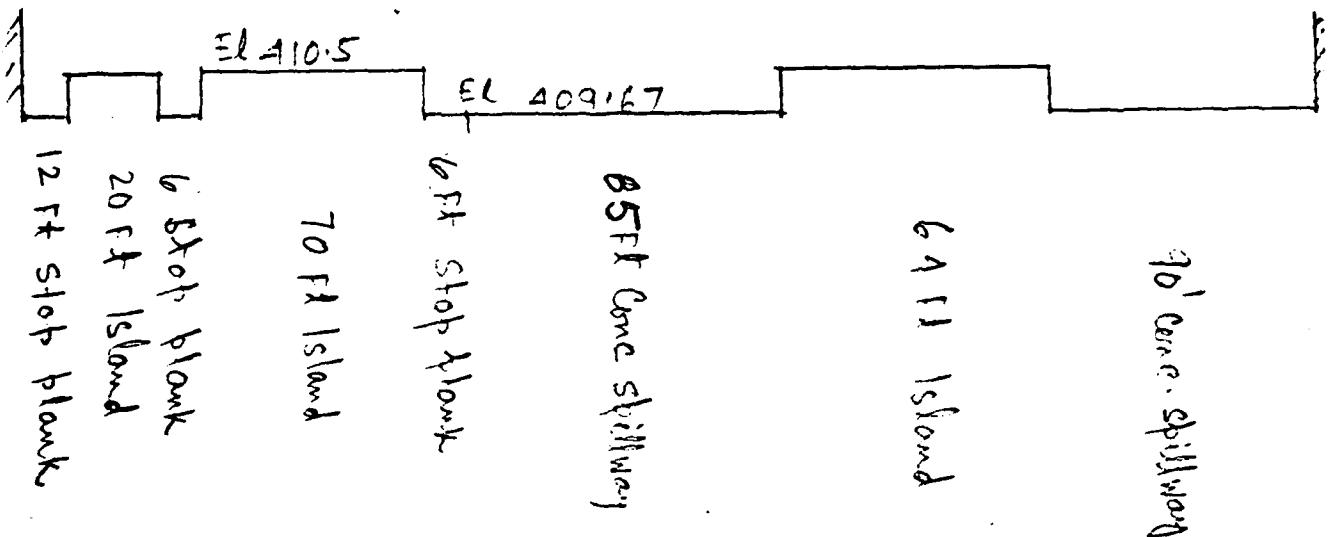
SCALE 1 IN 4 MILES

Inflow Hydrograph was determined from the Unit Hydrograph and PMP. Snyder's Unit Hydrograph parameters are reflected as

$$C_f = 3.70 \text{ and } C_p = 0.577$$

$$t_p = 4 (L L_c)^{0.3} = 3.7 (30 \times 16.8)^{0.3} = 23.9 \text{ hrs} = \dots$$

### Schematic Layout of Dam



Effective length of Spillway =  $L_s = 199 \text{ ft } C = 3.31$

Effective length of Dam =  $L_D = 154 \text{ ft } C = 2.5$   
(Very broad)

$$\begin{aligned} Q &= C_s L_s H_s^{3/2} + C_D L_D H_D^{3/2} \\ &= 3.31 \times 199 H_s^{3/2} + 2.5 \times 154 \times H_D^{3/2} \\ &= 659 H_s^{1.5} + 385 H_D^{1.5} \end{aligned}$$

Note: Stop banks are approximately 2' higher than the spillway. But at the time of inspection, it is found that leakage through the banks. Stop banks are considered at spillway level for the calculation of rating curve.

PRC Harris, Inc.  
CONSULTING ENGINEERS

SUBJECT N. J. Dam Inspection  
Penwell Mill Dam  
COMPUTED BY S.B. CHECKED BY

SHEET NO. 6 or  
JOB NO. 10-1176-01  
DATE March, 1981

$$W.S.EI \quad H_s \quad Q_S = 659 \quad H_s^{1.5} \quad H_D \quad Q_D = 385 \quad H_D^{1.5} \quad Q = Q_S + Q_D$$

409.67	0	0			0
410.5	1.83	498	0	0	498
412	2.33	2,344	1.5	707	3,051
414	4.33	5,937	3.5	2,521	8,458
416	6.33	10,495	5.5	4,966	15,461
418	8.33	15,843	7.5	7,708	23,751
420	10.33	21,679	9.5	11,273	33,152
425	15.33	39,555	14.5	21,257	60,512
430	20.33	60,408	19.5	33,152	93,560

K-E SEMI-LOGARITHMIC 5 CYCLES X 70 DIVISIONS  
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 6210

STAGE DISCHARGE :  
DENVER MILLY DAM

430

425

420

415

410

405

400

DISCHARGE 100,000 SEC

400

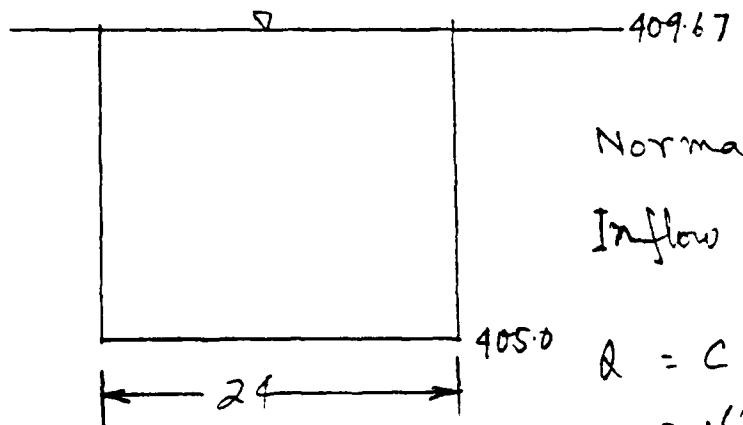
1000

100,000

7-

## Drawdown Computation

There are three stop planks, 2 each 6 ft wide  
and 1 each, 12' wide  
Total 24' wide.



Normal elevation to start = 409.67

$$\text{Inflow} = \frac{2 \text{ cfs}}{\text{mi}^2} \times 105.9 \approx 212 \text{ cfs}$$

$$\begin{aligned} Q &= CA \sqrt{2gh} & C &= 0.62 \\ &= 0.62 \sqrt{2g} A \sqrt{h} & \approx 5 A \sqrt{h} \end{aligned}$$

Assume tailwater elevation = 405.0

$$\begin{aligned} \text{Area } A_2 &= \left(\frac{h_2}{h_1}\right)^2 A_1 = \left(\frac{h_2}{4.67}\right)^2 \times 1.67 = 0.766 h_2^2 \\ (A_1 &= 1.67 A_2 \quad h_1 = 4.67 \text{ ft}) \end{aligned}$$

$$\text{Drawdown time} = \frac{\text{Vol in AF} \times 43560}{Q \times 3600} = \frac{12.1 \text{ Vol}}{Q} \text{ Hrs.} = 726 \frac{\text{Vol}}{Q} \text{ min}$$

$$\text{Drawdown time with inflow} = \frac{212 \times t}{Q} \text{ Hrs.}$$

Area of orifice Variable with depth  
= 24' x h.

Res Area Avg Vol 'Area' & 'Drawdown' Cum 'Drawdown' Cum  
E1 Res of orificia SANK time-t time with  
Depth A=24 ft  
ft ft ft CFS min min min min

109.67	1.67	1.45	.97	4.34	104	1084	.65	.65	.13	.78
409	1.23	.96	.96	3.5	84	786	.89	1.54	.24	1.91
408	.69	.50	.50	2.5	60	475	.76	2.30	.34	3.01
407	.31	.20	.20	1.5	36	221	.66	3.96	.64	4.31
406	.08	.04	.04	.5	12	43*	.68	3.64	3.35	8.34
405	0									

\* Inflow exceeding outflow: For practical purpose drawdown  
upto an elevation of 40 ft is considered  
Time of drawdown without inflow = 2.96 min & 3 min  
Time of drawdown with inflow = 4.31 min & 4.5 min

10

FLUID HYDROGRAPH PACKAGE (HEC-1)		JULY 1978	
UAN SAFETY VERSION		100' TERN FLUID (SER)	
LAST MODIFICATION 20 JULY 1978		N.J. DON INSPECTION	
<hr/>			
1	02	PENNELL, BILL DAN	
2	03	100' TERN FLUID (SER)	
3	04	0	0
4	05	0	0
5	06	0	0
6	07	0	0
7	08	0	0
8	09	RES	1
9	10	0	0
10	11	0	105.9
11	12	0	105.9
12	13	01	105.9
13	14	01	105.9
14	15	01	105.9
15	16	01	105.9
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218	219	01	105.9
219	220	01	105.9
220	221	01	105.9
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229	230	01	105.9
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243	244	01	105.9
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245	246	01	105.9
246	247	01	105.9
247	248	01	105.9
248	249	01	105.9
249	250	01	105.9
250	251	01	105.9
251	252	01	105.9
252	253	01	105.9
253	254	01	105.9
254	255	01	105.9
255	256	01	105.9
256	257	01	105.9
257	258	01	105.9
258	259	01	105.9
259	260	01	105.9
260	261	01	105.9
261	262	01	105.9
262	263	01	105.9
263	264	01	105.9
264	265	01	105.9
265	266	01	105.9
266	267	01	105.9
267	268	01	105.9
268	269	01	105.9
269	270	01	105.9
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271	272	01	105.9
272	273	01	105.9
273	274	01	105.9
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276	277	01	105.9
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278	279	01	105.9
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280	281	01	105.9
281	282	01	105.9
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286	287	01	105.9
287	288	01	105.9
288	289	01	105.9
289	290	01	105.9
290	291	01	105.9
291	292	01	105.9
292	293	01	105.9
293	294	01	105.9
294	295	01	105.9
295	296	01	105.9
296	297	01	105.9
297</			





جیلی ۲۰۰۰ء میں ۱۱ مئی ۲۰۰۰ء کو

the *lateral* and *anterior* *lateral* *lumbar* *nerve* *roots* *and* *spinal* *nerve* *roots* *are* *joined* *to* *form* *the* *lateral* *lumbar* *nerve* *which* *is* *distributed* *to* *the* *skin* *and* *muscles* *of* *the* *lateral* *lumbar* *region* *and* *the* *anterior* *lateral* *lumbar* *nerve* *is* *distributed* *to* *the* *skin* *and* *muscles* *of* *the* *anterior* *lateral* *lumbar* *region*.

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DATE